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ABSTRACT

Reported is a study on effects of early classroom teaching experience upon the attitudes and performance of teacher candidates from a student group primarily composed of science majors or minors. The subjects were paired mainly on their choice of a credential or noncredential program. One of each pair was randomly assigned to the experimental group and the other to the control group. An attitude inventory was given to both groups as a pretest and posttest. After taking the pretest, the experimental students were individually placed in the grade level and science area of their choice and spent a minimum of 3 hours per week in classroom for 12 weeks. Both elementary and secondary classes were involved in the study. The classroom assignment was observation, tutoring, small group teaching, developing and teaching one or two complete lectures or labs, and aiding master teachers. The experimental group also discussed their attitudes toward teaching career and received an evaluation by master teachers. The overall attitude changes were found to be statistically significant. The career decision and attitude development were independent of age, sex, class level, or grade point average. A realistic view of teaching was obtained by the experimental group. (CC)

THE EFFECT OF EARLY CLASSROOM TEACHING EXPERIENCE UPON THE ATTITUDES AND PERFORMANCE OF SCIENCE TEACHER CANDIDATES

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INTRODUCTION

RATIONALE FOR THE STUDY

"Those who can, do; those who can't, teach." Unfortunately, this prevalent opinion of a teacher seems too often true. College students majoring in science, particularly biological science, may reach their senior year with grades or funds too low to allow their admittance to ~~school~~ medical or graduate school, unprepared for a specialized career such as public health or medical technology, or with no future plans except an interest in science. For the past 20 or more years, one career that has had a shortage of qualified people and has been open to students with a generalized textbook-science background has been teaching.

But rarely have students a realization of or preparation for a teacher's role. Even students who have planned for a teaching career often have little if any experience working with groups of children. Teacher candidates in California universities and colleges usually have no formal opportunity to participate in a grade school classroom until their fourth or fifth year of college. By then, if a candidate decides he does not enjoy teaching children, it is usually too late to change professions without at least one or two years of additional study and expense.

Until three years ago, teachers, particularly science teachers at all grade levels, were in demand. But coupled with decreasing funds for education and a growing attitude of suspicion that science has created rather than solved many human problems, supply has equalled or surpassed the demand for

teachers. The Career Placement Office at California State University, San Jose, placed only 70% of its teacher applicants in 1971, and estimates even lower placement for 1972--a startling drop from many years preceding 1971 of nearly 100% placement, especially in science. It seems obvious that teacher training institutes must make teaching a career for those best suited to it, and not a career for drop-outs. Unless candidates can early become aware of the variety of responsibilities toward teaching, toward pupils, and toward the subject area that a teacher must live and cope with, they may be burdened with a job they do not enjoy, and their pupils will be hampered in their education by unhappy and often unfit teachers. Instructors of natural science and science education too frequently have student teachers tell them, "If I had known teaching kids was like this, I'd never have gone into teaching."

In a proposal for early classroom teaching experience by the State University College at Buffalo in 1970, it was stated that,

> "Some students are not emotionally or mentally geared to teach children. A student may discover this fact in senior practice teaching and be unable for vocational or financial reasons to 'phase out' of the profession. ...Through early contact with children in the junior year, with careful behavioral assessment, a student may constructively select himself out or be selected out on behavioral grounds."

The preteaching period seemed to be a time of relatively low involvement in teaching and high concern about the student's self. Late in the semester, after classroom experience, student teachers were more concerned about pupils than earlier, when their concentration was mainly about themselves and how they performed, not what the pupils gained. Early experience has not only changed the student's view of teaching, more to teaching than they previously thought, but students have begun to take a personal interest in

children and respect them as individuals. Many neophyte teachers identify with the pupils rather than with adults and teaching tasks. Even a 15 minute exposure to classroom teaching caused students to focus on pupil concerns rather than on self concerns, ("How was my voice?" etc.). Students also expressed surprise that teaching was so much work. Students experienced statistically significant reduction in anxiety about teaching, and became more sensitive to individual differences in children. Student teachers' anxieties are greater from the anticipation of the experience of teaching than from the assignment itself. It has been suggested that,

> "The most important aspect a field experience can offer to the student's education is the development of his self concept. ...This knowledge is vitally important, for it can aid him in matching his own personality, abilities, and aptitudes to those required by a future career."

Those students who cannot turn their concerns from self to pupils, whether because of immaturity or lack of interest in teaching people as opposed to teaching content, should not become teachers. Early classroom teaching experience (prior to student teaching) may act as an effective screening process. If immaturity causes a student to withdraw from a teaching career, he nonetheless has the experience upon which to base a mature reconsideration. If a student can give a mature consideration to a teaching career, he can base it upon the actual, many-faceted role of a teacher. It is believed that early classroom experience would familiarize students with the problems and concerns of teaching and help them to answer the question, "How may I be assured that teaching is for me before it is too late to change my college plans?" The question is also partially answered by the college and grade school supervisors' evaluations of the students. If a student participating in early classroom teaching experience does not

acquire attitudes toward teaching, toward pupils, and toward the subject and self that are considered desirable, the student can be counseled out of teaching early. The selection process of teachers could follow a year of actual work with children, at which time a mutual decision could be reached based upon behavioral performance. (It is also recommended that "Clinical personnel [be involved], not college professors...because they lack relevant experiences. ...Clinical personnel, people on the job ...perform as well as verbalize." Master teachers involved in this study have been both very enthusiastic with the idea of early classroom experience and very willing to cooperate, voluntarily, in this project.)

Early experience can result in making education courses, the bane of many students, more meaningful. During a field experience, the student has an opportunity to develop new interests. These in turn often can motivate him to pursue academic subjects with far greater intensity. The sooner young teachers become involved with actual teaching, the sooner much of their educational course content becomes relevant to them. The Florida State Study (1970) concluded that students found psychology and methods courses given following or simultaneously with classroom experience ~~became~~ more meaningful because the theory could be applied practically.

There is also a mutual benefit between the student and the community. Teaching aides provide a service to the community by helping both the teacher and the pupils. They often become involved in service beyond the classroom, getting exposure to the neighborhood and the broader community, learning to accept, encourage, and enjoy ethnic and cultural differences, and maturing with a wide variety of experiences. "The student, both as a citizen and as a prospective teacher, needs to grow toward an ever increasing understanding

of society, education and teaching." (Florida State Study, 1970). The side effects of involvement in an early classroom teaching experience can extend, then, to exposure to other possible careers in both subject and service areas, to a better relationship between the community and the college, to a contribution of service and inspiration to other people--often inner city and disadvantaged, and to the education of the student in the full sense of education.

STATEMENT OF THE PROBLEM

In view of a surplus of teachers at all grade levels, the problem is to determine how colleges can best help students to decide whether or not they should become teachers while they are still able to change their goals without the penalty of extra time and funds. If the results of this study indicate that early classroom teaching experience serves to help students screen themselves into or out of teaching before they are committed to a teaching career, and acquire a more realistic view of teaching through the development and enhancement of attitudes favorable toward teaching, then both the colleges and the students will indeed save time and funds while improving the quality of teachers and education.

HYPOTHESES

This study was designed to test the following hypotheses:

As a result of early classroom experience in teaching science, students will:

1. Demonstrate development or enhancement of attitudes favorable toward teaching as indicated by the difference of mean change scores of the total and subtest scores of the experimental and control groups at the .05 level of significance.

2. Demonstrate that particular categories of students are especially helped to develop or enhance attitudes favorable toward teaching, as indicated by the difference of mean change scores of the total and subtest scores of the experimental and control groups at the .05 level of significance.

3. Demonstrate that they have reached a decision as to whether or not they will make teaching their career, as indicated by the percent of students in the program who drop the course or state their decision through a subjective questionnaire or verbally to the investigator.

4. Demonstrate awareness of their strengths and weaknesses through conferences with the investigator and master teacher and a written evaluation by the master teacher.

SAMPLE, DESIGN, AND METHOD

SAMPLE

The students who participated in this study were volunteers who agreed to be selected at random for the experimental or the control group. Letters of explanation were sent to all sophomores, juniors, and first semester seniors in the School of Science at San Jose State College (now California State University, San Jose) who were working toward a B.A. in all science majors except microbiology. (The microbiology major was so specialized as to not lend itself to the teaching of grade school science.) The following semester, letters went to all transfer students who had entered San Jose State College during the previous fall semester, and fulfilled the same qualifications. Altogether, about 400 letters of explanation were mailed.

Approximately 60 students expressed interest in participating the first semester, and 20 the second. Of these, 24 matched pairs completed the course the first semester, and 7 matched pairs the second. In addition, 6 students in the control group the first semester were part of the experimental group the second, and served as their own controls. However, their attitude inventory scores were not included in the analysis of the data. Because the students were so highly motivated as to ask to be part of the experimental group the second semester, and because the study was conducted through a course approved by the College, restrictions could not be applied to the extent the investigator preferred.

EVALUATION INSTRUMENTS

Through several years of teaching, observing, and supervising teaching candidates, the author became aware of a great need for early screening of prospective teachers, particularly those students who changed

to a teaching major because of low grades, indefinite goals, personality problems, or other reasons which kept them from achieving a goal or a job with a B.A. in one of the sciences, especially biological. These people usually became poor and dissatisfied teachers, also. In an effort to alleviate this situation, the investigator set up an experimental course, Science Education 196, (later made a regular course, Sci. Ed. 175, Early Experiences in Classroom Teaching), to offer classroom experience as a means of aiding career decision. In addition, the course offered experience in working with children, a factor the School of Education began using in 1971, with the mounting teacher surplus, as one of its criteria in selecting students for admission to the Education Block of courses. Grading was pass-fail for one semester-unit credit, the pass grade to be given if the student put in 40 hours of classtime, however well or poorly he performed. In addition, the Dean of the School of Science agreed to allow students to withdraw at any time during the semester, contrary to the usual College practice. All attempts possible were made to de-emphasize grades in order to allow the student to explore teaching without pressure.

Some means of evaluating both the course and the students' growth were necessary. Growth was determined by three factors: changes in attitudes, changes in teaching performance, and, indirectly, how satisfactory teaching as a career would be for the student. The best known and most widely used test to measure these is the MTAI (Minnesota Teacher Attitude Inventory). It was deemed unsatisfactory for this study because it appeared somewhat obsolete with respect to current philosophy of a teacher's role and because it did not appear to measure qualities of a student untrained in or undecided about teaching. While others have found the MTAI satisfactory, the investigator

preferred an inventory more specifically measuring attitudes determined desirable for this study.

As a means of evaluating any gains in the attitudes and attributes which a student might achieve through participating as a teaching aide in an early classroom teaching experience, a Pre-Service Teaching Attitude Inventory was devised, to be used as a pre- and posttest immediately prior to and following the experience. The various attitudes and attributes were condensed into seven groups which the investigator believed an inexperienced, science-oriented student considering teaching as a career should have or should develop after exposure to and experience in a classroom under an outstanding master teacher. The seven attitudes concern:

1. The teacher as a facilitator of knowledge, the teacher's role and function.
2. The teaching of content (fact) vs. process.
3. Laboratory and activities orientation vs. reading, lectures, and cookbook labs (passive learning).
4. Attitudes toward science and the role of science.
5. Teacher preparation education: background of knowledge, college courses, in-service continuing education.
6. Environment for learning: teacher-oriented vs. student-oriented, student interaction, individualization.
7. Self image, personal worthiness.

In the final Attitude Inventory, which consisted of 57 items scored on a five point strongly agree to strongly disagree scale, the average number of statements used per subtest was eight, and the correlation coefficients ranged from 0.32 to 0.60, with all but those of six statements at or above 0.40.

EXPERIMENTAL DESIGN

The experimental design for this investigation was adopted from Campbell and Stanley's (1963) pretest-posttest, control group design:

R O X O

R O O

In addition to the Pre-Service Attitude Inventory, a subjective evaluation of the course itself was used. A questionnaire was given to determine, by short answer responses, if the student felt he received sufficient directions as to his role as a teaching aide, if the experience helped him to clarify a teacher's role, whether or not he planned to become a teacher after his experience, and so on.

METHOD OF MATCHING PAIRS

Each student who volunteered to participate was sent an information sheet to complete. From this, pairs of students were matched for the experimental and control groups. The information sheet contained 14 items, hierarchically arranged according to their importance in matching. The students were usually identically matched on the first 9 or 10 items.

Of prime importance was whether or not the student was enrolled in the credential program, and hence already motivated toward teaching. Then students were matched on their choice of an elementary or secondary credential, which often coincided with an emphasis on concern for children or concern for the subject matter. Students who were planning on a secondary credential were matched on the area of their discipline. Non-credential majors were similarly matched. Of great importance was whether the student had previously worked with children. This was followed by demographic information: age, sex, class level, grade point average, socio-economic level of the family, academic level of the student's high school (which often reflected his view of a teacher's role), and the father's and mother's occupation. One of each pair was then randomly elected for the experimental group. The two exceptions were students who volunteered only for the control group because of heavy course loads during the year.

METHOD OF CONDUCTING COURSE

Since early classroom experience was offered from kindergarten through grade 12 in regular, special, and continuation education classes, with the only common requirement a content emphasis on science, the course was individualized and flexible. At the first class meeting both the experimental and control groups took the Attitude Inventory. The control group then left. Each experimental group student listed his preference as to grade level, socio-economic and ability level, geographical area, area of science, and any other idiosyncracies such as not wishing to have a woman for a master teacher. At the second meeting, students were given their assignments and directions. Thereafter, students who wished to do so were asked to report their progress biweekly and individually. The remainder were asked to report once a month, and at any other time they needed assistance. No additional group meetings were scheduled until the last week of the semester, when both the experimental and control groups took the posttest. Only the experimental group completed the evaluation questionnaire.

During the first and second meetings, students were also given their general instructions and time schedules. Each student was to spend a minimum of three hours per week for 13 weeks in the classroom, the time to be arranged in accordance with the master teacher's schedule and the college schedule. Attendance could be once or several times per week. The student was to make an appointment with the master teacher to discuss the time schedule, get a classroom lesson schedule, and borrow the necessary grade school textbooks. On his own time, the student was to know enough of each lesson's content in advance to be able to tutor both lecture and laboratory sessions. In high school advanced science classes, this often represented a challenge even to

advanced college students. The student was given a loosely structured schedule. 1) Observe during the first two or three visits, after obtaining a seating chart, and learn from observation and discussions with the master teacher as much as possible about each student's role in the class. 2) Tutor individuals for the next several visits. 3) Work with small groups, in addition to tutoring individuals, for the remainder of the semester. 4) Toward the end of the semester, make arrangements with the master teacher to develop and teach one or two lessons on a science subject the student was comfortable with, including the lecture and/or lab and a quiz or other evaluation. 5) In addition, the student was to spend part of his time with periferal duties: dittoing, correcting papers, taking roll, helping to set up and clean up equipment and prepare experiments, attend science staff meetings, meet the faculty informally, observe other teachers occasionally, and "become involved." The periferal duties were not to occupy more than 25% of the student's in-class time, the remainder to be spent interacting with the pupils. (Nevertheless, students expressed dismay and disgust at all the periferal duties teachers had to spend time doing, and resented having to do them.)

SELECTION OF MASTER TEACHERS

A selection of local outstanding elementary and secondary science teachers to be master teachers for the participating students was made from personal judgment and that of colleagues who taught and supervised student teachers in science. Letters explaining the program and asking for cooperation were sent to the selected teachers. All responded favorably to the program, and most were able to take on a teaching aide, despite their not receiving financial compensation and despite the additional work involved.

Almost all who cooperated have been willing to accept or requested teaching aides each subsequent semester.

With few exceptions, no attempt was made to assign a student to a particular master teacher for reasons of personality, sex, style of teaching, etc., since there was little room for flexibility after the demands of grade level, area of science, and geographical restrictions were met. In several instances, students who were very traditional or non-structured and liberal worked with their opposite types to help them understand that outstanding teachers come in all styles of teaching. In all instances, the initial shock gave way to a successful coupling.

The master teachers were given roughly the same instructions as the student aide. At a post semester evaluation meeting, the teachers expressed more concern about the lack of specific instructions than the students. Opinions varied depending upon the student involved, but the teachers having the better students found them to be more of an asset than a liability.

An initial assumption in this study was that only the best master teachers should be used during this early formative stage of classroom experience. They would provide a model the student would associate with excellence in grade school teaching and contrast with the lecture-textbook style used in college and often in secondary schools.

The investigator was told by some students who had especially outstanding master teachers how "easy" teaching and maintaining control were. After following the request that they observe one or two classes taught by average and poor teachers, the students felt they had gained considerable insight into excellence in teaching.

EVALUATION OF THE TEACHING AIDE

The 24 students of the first semester's experimental group were also asked to consider on which specific qualities they wished to be evaluated. As a guide, they were asked to consider by which qualities they judged their master teachers. Toward the end of the semester, each student wrote a list of items in response to "What do you want to know about yourself as a potential teacher?" Nearly half the 37 evaluation statements came directly from the students, their statements emphasizing items like their ability to maintain discipline (a prime concern), and how the pupils liked them. The evaluation form also asked for comments covering the student's weaknesses, strengths, and potential as a teacher. The answers for the majority were unhesitatingly candid.

Master teachers were asked to have five of their pupils, preselected according to their numerical position in the roll book, evaluate the student also. However, many of the statements were not applicable for pupil judgment, the elementary and junior high school pupils were unable to do this without teacher help, and the high school pupils' responses were either totally favorable or corresponded very closely with the master teacher's. Therefore, this means of evaluation was discontinued.

Evaluations by different individuals about different individuals under differing circumstances tend to vary considerably. However, each master teacher received a cover letter with the evaluation form emphasizing the need to be highly critical in order to be constructive and useful to the student. Also emphasized was the automatic pass grade of the course and the secrecy of the evaluation--only the teacher, the student, and the investigator were to see it. Largely due to the emphases of the cover letter, most of the

evaluations did seem to be very thorough, and were then sent to the respective students.

ANALYSIS OF DATA

Exploratory studies, such as this, do not generally yield precisely quantified data. In this study, the data which can be quantified are based upon the differences of the pre-post test attitude inventory scores between the experimental and control groups: $D=(X_2-X_1)-(Y_2-Y_1)$

Where: X_2 = posttest score, experimental group

X_1 = pretest score, experimental group

Y_2 = posttest score, control group

Y_1 = pretest score, control group

The differences will be formally assessed through use of confidence intervals of the form:

$$\mu_D = \bar{D} \pm s_{\bar{D}}$$

The statistical significance of the differences of the mean change scores of the total test and subtests for various categories of students will be formally assessed through use of the t test for matched pairs and the two sample t test for two independent groups.

Further analyses will be informal. These data analyses suggest trends which can be considered in science teacher preparation programs, but will not be analysed for statistical significance.

FORMAL ANALYSIS

Tables I and II cover mean change score differences for the total score and the seven subtests of the attitude inventory. The subtests consist of

the following areas of attitudes:

I Teacher as a facilitator of knowledge

II Content emphasis vs. process emphasis

III Activities vs. lecture, reading, passive learning

IV Attitude toward science ~~and technology~~

V Teacher preparation and continuing education

VI Teacher-oriented vs. student-oriented environment

VII Self image

Each subgroup of individual items represents a variety of approaches toward the determination of a specific attitude. Since this study is not directed toward further analysis of the value of each item beyond the cross correlation matrix of the pilot study, no further focus will be placed upon the individual items.

The subtest change scores, which represent the attitudes this experimental program has been designed to develop and enhance in students, are of substantial concern. The total change score is of major concern.

Table 1

MEAN AND STANDARD ERROR OF D
(Total and subtests)

Total	7.323	2.314
I	.323	.890
II	1.516	.694
III	1.581	.776
IV	.806	.596
V	1.097	.955
VI	1.355	.913
VII	.645	.733

The total ~~score~~ mean gain score of the experimental group exceeds that of the control group by more than three standard errors, suggesting strongly a

substantially greater development or enhancement of attitudes considered favorable for teaching through the use of this experimental program. All subtests indicate a larger gain by the experimental group. Subtests II through VI yield a difference of mean gains beyond one standard error, uniformly favoring the experimental group.

These data may also be displayed more conventionally in terms of the confidence limits for a 95% confidence interval, using the t distribution. These results are given in Table 2.

Table 2

LOWER AND UPPER LIMITS OF THE
95 PERCENT CONFIDENCE INTERVAL
(Total and subtests)

Total	2.602	12.044
I	-1.493	2.138
II	.101	2.932
III	- .002	3.163
IV	- .410	2.023
V	- .852	3.046
VI	- .508	3.217
VII	- .849	2.140

The intervals for subtest II and the total score do not cover zero, indicating statistical significance. The lower limit of the confidence interval for subtest III is -.002, virtually zero; therefore, it can, for all practical purposes, be considered statistically significant also.

The order of the tables of comparison of categories of students given below follows that of the demographic information questionnaire. The first table compares the differences of the mean change scores of experimental and control groups of elementary credential, secondary credential, and secondary non-credential students, by means of the t test for matched pairs Since only one subject was an elementary non-credential student, no analysis was made for that category. The last two tables compare the secondary credential experimental group with the secondary non-credential experimental group, and the experimental group experienced in working with children with the experimental group not experienced in working with children. The two sample t test for independent groups was used to determine statistical significance for the last two categories.

Table 3

COMPARISON OF CREDENTIAL AND NON-CREDENTIAL EXPERIMENTAL AND CONTROL GROUPS
(Total and subtest mean change scores)

Group	Total	I	II	III	IV	V	VI	VII
Elementary Credential #7‡	6.571	.898	-1.286	2.571	1.143	1.715	2.000	-.715
Secondary Credential #9	3.777	-.334	1.556	2.222	- .889	-1.000	2.223	.777
Secondary Non-Credential #10	10.000*	-.600	1.500*	2.300	2.800*	.900	2.100	1.300

‡ = No. matched pairs of subjects
* = Significant at the .05 level

At the elementary level, there was a definite gain in the attitude toward activities vs. lecture, reading, and passive learning. There were slight gains in the attitudes toward teacher preparation and continuing education and toward a student-oriented rather than a teacher-oriented classroom environment. At the secondary credential level, there is a definite gain in the attitude of content vs. process. Surprisingly, both the experimental and control groups gained highly ~~and equally~~ in their attitude toward activities vs. reading and lecture. Both teacher vs. student-oriented environment and self image attitudes showed slight gains.

At the secondary non-credential level, the experimental group showed gains in all attitudes except that of the role of the teacher as a facilitator of knowledge. The total mean gain and those of the subtests measuring attitude changes in content vs. process and science were statistically significant. Gains in attitudes toward activities vs. passive learning and teacher vs. student oriented environment were also substantial.

Table 4

DIFFERENCES OF MEAN CHANGE SCORES OF SECONDARY NON-CREDENTIAL AS COMPARED TO SECONDARY CREDENTIAL EXPERIMENTAL GROUPS ‡
(Total and subtest mean change scores)

Total	I	II	III	IV	V	VI	VII
2.100	-.262	-2.254*	.223	2.108	3.046*	-.238	-.223

No. subjects = 13 in non-credential group, 10 in credential group.
* = significant at the .05 level
‡ Positive number denotes gain by non-credential group.

The secondary non-credential experimental group gained substantially in the total score and in the subtests relating to the attitudes toward

science and teacher preparation, the last being statistically significant. However, the secondary credential experimental group gained at a statistically significant level in the attitude toward content vs. process.

Table 5

DIFFERENCES OF MEAN CHANGE SCORES OF NON-EXPERIENCED AS COMPARED TO EXPERIENCED EXPERIMENTAL GROUPS‡
(Total and subtest mean change scores)

Total	I	II	III	IV	V	VI	VII
1.656	.469	2.409*	.202	-.475	-1.400	-.793	1.394

No. subjects = 9 in non-experienced group, 22 in experienced group.
* = significant at the .05 level
‡ Positive number denotes gain by non-experienced group.

Students not experienced working with children showed a statistically significant gain in the attitude of content over process, and a substantial gain in their attitude toward a self image. Somewhat surprisingly, they showed a substantial decline in the attitude toward teacher preparation.

INFORMAL ANALYSIS

The factors of age, sex, class level, and grade point average were informally analyzed. These comparisons were meant to indicate possible trends only. Mean change scores for each division of each factor are given.

Table 6

COMPARISON OF MEAN CHANGE SCORES OF EXPERIMENTAL AND CONTROL GROUPS AS RELATED TO AGE

Age levels	17-18	19-20	21-22	23-24
Elementary				
Exp.	--	(4) 2.5	(2) 5.0	(1) 3.0
Con.		(2) -6.0	(1) 10.0	(2)-17.5
Secondary				
Exp.	(2) 16.0	(12) 11.0	(6) 4.7	(1) 4.0
Con.	(3) 4.3	(10) 2.1	(4) 3.0	(3) 3.0

In all but one case where there was a basis for comparison, the experimental group gained more than the control group, but age appeared to be a factor of no particular consequence. Secondary students between age 17 and 20 had greater gains than those over 20, but this may be due to chance rather than age.

Table 7

COMPARISON OF MEAN CHANGE SCORES OF EXPERIMENTAL AND CONTROL GROUPS AS RELATED TO SEX

	Male	Female
Elementary		
Exp.	(3) 2.3	(5) 6.0
Con.	(3) -6.3	(5) 3.0
Secondary		
Exp.	(17) 9.8	(6) 7.2
Con.	(17) 2.6	(6) -1.7

Number in parentheses denotes numbers of subjects.

Elementary females scored higher than elementary males. Secondary males scored higher than secondary females. Again, this may be due to chance rather than sex.

Table 8

COMPARISON OF MEAN CHANGE SCORES OF EXPERIMENTAL AND CONTROL GROUPS AS RELATED TO CLASS LEVEL

Level	Sophomore	Junior	Senior
Elementary			
Exp.	(1) -7.0	(4) 9.3	(2) - 3.5
Con.	(2) -6.0	(4) 3.3	(2) -17.5
Secondary			
Exp.	(7) 14.6	(11) 8.5	--
Con.	(6) 5.7	(16) 0.8	--

Number in parentheses denotes numbers of subjects.

As with age, no pattern emerges from the elementary group, but the lower the class level for the secondary group, the more the gain. This roughly corresponds with age levels, but again may be due to chance.

Table 9

COMPARISON OF MEAN CHANGE SCORES OF EXPERIMENTAL AND CONTROL GROUPS AS RELATED TO GRADE POINT AVERAGE

GPA	1.5-2.0	2.1-2.5	2.6-3.0	3.1-3.5
Elementary				
Exp.	--	(2) 19.5	(2)- 7.0	(3)- 0.7
Con.	--	(2)- 8.5	(2) 11.0	(4)- 9.8
Secondary				
Exp.	(3) 12.0	(7) 9.1	(10) 8.9	(1) 7.0
Con.	(2) 2.0	(9) 1.8	(7) 3.6	(3)- 1.0

Secondary students, and, to a certain extent, elementary students seem to gain more (as indicated by the mean change scores), the lower their grade point average.

RESULTS, DISCUSSION, AND CONCLUSIONS

1. The first hypothesis was stated as follows: As a result of early classroom experience in teaching science, students will demonstrate development or enhancement of attitudes favorable toward teaching as indicated by the difference of mean change scores of the total and subtest scores of the experimental and control groups at the .05 level of significance. The experimental group, as compared with the control group, developed or enhanced attitudes favorable toward teaching with a total mean change score difference statistically significant at the .05 level.

The experimental group, as compared with the control group, developed an attitude toward emphasis on process learning over content learning (subtest II) with a subtest mean change score difference statistically significant at the .05 level.

The experimental group, as compared with the control group, developed an attitude toward emphasis on activities over reading and lectures (subtest III) with a subtest mean change score difference statistically significant at the .05 level.

All other subtests showed mean ~~change~~ gain scores for the experimental group over the control group, but none were significant at the .05 level.

2. The second hypothesis was stated as follows: As a result of early classroom experience in teaching science, students will demonstrate that particular categories of students are especially helped to develop or enhance attitudes favorable toward teaching, as indicated by a comparison of mean

change scores of the total and subtest scores of the experimental and control groups.

No comparisons were made for credential vs. non-credential elementary students, but the elementary experimental group showed [redacted] positive gain. None of the tests, total or subtests, were significant at the .05 level. The category of experimental students who were already enrolled in the secondary credential program made a substantial [redacted] mean change score over the control group. However, none of the gains were significant at the .05 level. The gains of the experimental non-credential students (generally those exploring teaching as a possible career) over the control group in the total gain and the gains for subtests II and IV were significant at the .05 level.

In the category of secondary credential experimental group students compared with secondary non-credential experimental group students, the gain of the credential students in subtest II was significant at the .05 level. The non-credential students had a gain in subtest V which was significant at the .05 level.

[redacted] gains were made by the category of students who had no previous experience working with children in any capacity as compared with those who had. Of the nine students in the former category, two were elementary candidates, four were secondary candidates, and three were non-credential students. ~~Each student gained in every subtest.~~ However, only the gain for subtest II was significant at the .05 level.

An increase in age and class level, which is related to age, was accompanied by a slight decrease in mean change scores for the experimental groups. Otherwise, sex, grade point average, age, and class level appear to have had no association with attitude mean change scores. No tests for significance were performed on these categories.

In summary, the results of this study indicate that some easily distinguishable categories of students will tend to be helped by early classroom teaching experience substantially more than others. This hypothesis, therefore, is accepted.

3. The third hypothesis was stated as follows: As a result of early classroom experience in teaching science, students will demonstrate that they have reached a decision as to whether or not they will make teaching their career, as indicated by the percentage of students in the program who drop the course or state their decision through a subjective questionnaire or verbally to the investigator.

Six students, of the 37 who began in the experimental group, withdrew from the course before completing it. Two of the six withdrew early in the semester because the course took too much of their time. The other four were late withdrawals, and stated their reasons for dropping as not wanting to continue in teaching because it was too much work or they did not like teaching. In response to the question on the subjective evaluation, "Do you still plan to teach?" three of the 31 students who finished the course replied "No." One student changed his major because he did not like teaching science. Twelve are still uncertain about continuing or going into teaching, but stated that they have a much more realistic view of teaching. (One student stated, "I've lost my illusions.") The remainder replied that they had even more incentive to become teachers.

4. The fourth hypothesis was stated as follows: As a result of early classroom experience in teaching science, students will demonstrate awareness of their strengths and weaknesses through conferences with the investigator and master teacher, and through a written evaluation by the master teacher.

No attempt was made to quantify this hypothesis. Each student has discussed problems which have come up in the classroom. These have mainly been concern about discipline and classroom control. Occasionally, there has been concern about lesson planning and presentation, a recommended but not required part of this course. Certainly most students who seek aid are aware of their deficiencies and weaknesses. The master teachers and the investigator have tried to make them aware of their strengths. Hopefully the best and most obvious judgment has come from the response of the classroom pupils. In a quantitative judgment, the best source appears to have been the written evaluation by the master teacher. While all the master teachers have tried to be objectively critical, some were more severe than others. The more severe the criticism, the more help the evaluations have been to the students in making them aware of themselves as potential teachers. About half the students received the evaluations directly from the investigator; the remainder were mailed. Not one of the students offered any comments about the evaluation.

DISCUSSION

In consideration of the total and subtest mean change scores and their results, hindsight suggests explanations. Subtest scores indicate that most of the experimental group developed or enhanced attitudes considered favorable by educators today. However, several students, upon completing the posttests, remarked that after being exposed to a classroom for a semester, they no longer were so positive about many of the statements, and tended to score many less definitely than on the pretest. This may account for some of the negative change scores of the experimental group.

Subtest I, The Teacher as a Facilitator of Knowledge, had the least mean gain. Today's average college student rarely considers grade school

teachers as the source of all knowledge and truth. The media--books, journals, T.V.--have become the source. Science majors, taught to be skeptical and tending to find out answers on their own, might tend to view a grade school teacher's role as a guide or director rather than a teacher or encyclopedia. This would, in part, explain the general lack of gain in this attitude.

Subtest II, Content vs. Process, showed a significant change of attitude, particularly for secondary credential and non-credential and non-experience students, toward acknowledgment of the learning of processes and skills as opposed to the learning of only or mainly content and subject matter. Since college focuses almost entirely on subject matter, and process and skill learning are not only subtler but rarely emphasized, it seems to take the actual teaching experience before students become aware of the breadth of learning and all that "learning" encompasses, that takes place in a classroom. One student wonderingly stated, "I had to show the kids how to tip both the beaker and the testtube when they wanted to pour something instead of just plopping the testtube over," in making vivid his sudden awareness that teaching was more than chemistry concepts.

Subtest III, Activities vs. reading, lectures and other forms of passive learning, showed the highest gains. At the elementary level, students expressed surprise that science was activity oriented, that pupils were supposed to do something, not simply read about it. At the secondary level, laboratory and field projects formed a major part of the curriculum. Both experimental and control group secondary students gained greatly and equally in their attitude toward an activity oriented classroom. Examination of individual scoring revealed no trends to suggest any reason for the high scoring of the control group. ~~Experimental group non-credential students~~

~~and non-experienced students were particularly pronounced in their gain scores in this attitude despite the lack of statistical significance~~. Gains in this area of attitudes are particularly important in view of today's Piagetian-based concepts of learning development and the increase in vicarious learning through the media rather than through concrete experiences.

The remaining subtests showed little ~~change of~~ gain in mean change scores for any group or category of students. The less teacher-education and/or child-oriented a category of students was, the more favorably their attitudes changed in subtests IV, V, VI, and VII. Possibly these students were more optimistic or expectant of what teacher education courses could offer, particularly those students not in the secondary credential program.

Subtest VII, Self Image, may have shown little change because the experimental group students worked largely with the best of master teachers. All of the teachers appeared to have a sense of personal worthiness and a wholesome self image. Thus, they did not provide the occasion for the students to make comparisons between a confident teacher and one who used the pupils to make himself feel successful.

Several students who felt class control and discipline were simple to achieve were asked to observe less able teachers. The students were then asked to compare the differences between the two teachers in order to help them discriminate qualities which included self confidence and a good self image.

It is somewhat difficult to evaluate the numerical meaning of the gain scores of the subtests. Each subtest contained seven to ten statements with an average of eight. If the mean gain of a subtest was three or four points, then the experimental group developed a more favorable attitude

toward teaching on half the statements corresponding to that attitude. This would appear to be a substantial change. The change occurred mainly in two attitudes which comprise an approach to teaching rather than a change in the teacher, namely physically active participation in learning processes and skills. With a philosophical goal of today's theory of education one of continuous lifelong learning, that approach is considered essential.

Although most of the questions on the subjective questionnaire referred to evaluation of the class procedure, which required the students to take the initiative once they had been assigned to a master teacher, two questions related directly to this study. One question asked, "Do you still plan to become a teacher?" which was discussed in Hypothesis #3. The other asked students to list two or three "discoveries" about teaching which they learned through taking this course. Well over half stated that they had learned that teaching was far more work than they had previously imagined, and many of the students still undecided about a teaching career said the time and work involved in teaching was a major factor against teaching as a career. Other "discoveries" included concern about class discipline that did not appear to lessen with continued experience in the classroom; enjoyment in working with children, need for patience, flexibility a positive attitude, involvement, tolerance, insight, enthusiasm, etc., plus one student who maintained that he "learned nothing," (and whose master teacher agreed).

The program also offered students experience at grade levels other than the one they originally selected. In several cases, both during the study and subsequent to it, students either changed grade levels or professed that, while they still wanted to teach, they did not want to teach at the grade level they selected. This seemed particularly true of students working with junior high school pupils (grades 7-9).

The degree of enthusiasm was coupled more with persistence than ability. The time students spent in the classroom ranged from irregular attendance totaling barely the minimum requirement to seven or eight hours per week. A few students continued to aide the teacher on their own time during the spring semester. The better students were asked to return as student teachers or interns, or were hired for part time special projects.

Perhaps the major reason this course was successful, and has been made a regular part of the curriculum, is because of the close liaison between the student, the master teacher, and the college instructor. Other departments offer similar experiences without guidance and help from an instructor. The student receives a learning experience but it is not backed by a measure of confidence that comes from knowing that he will have help when problems occur. In this course, problems arose in teaching methods, content, with the pupils, with the master teacher, and with a particular school situation. Both the "no penalty" evaluation and guidance when and where students need it, especially students who are not familiar with education and/or children, are the essential, if time-consuming, parts of this course.

CONCLUSIONS

Early classroom experience in teaching science, offered to sophomore and junior class college students, helps them to reach a decision as to whether or not to make teaching their career. It also develops and enhances attitudes considered favorable toward teaching. The career decision and attitude development are not dependent upon the age, sex, class level, or grade point average of the student. The early classroom teaching experience had the least effect upon elementary candidates, who appear to enter the

program already motivated toward a teaching career. It has a substantial effect upon secondary candidates, and particularly so upon non-credential science majors who are considering teaching as a possible career. Early classroom teaching experience appears to have ~~a major~~ an effect upon the attitudes and decisions of students who have had no previous experience working with children. The major effect itself is one of an approach to teaching rather than a direct effect upon the teacher, that is, an emphasis upon learning as a physically active participation in learning processes and skills, with the focus on the learner, not the teacher.